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THE EFFECTIVENESS OF THE
FEDERAL POWER COMMISSION

418 - 69A

✓ Paul W. MacAvoy

Revised

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A confrontation between experts on efficiency and the Federal Power Commission would be less than an appropriate subject for an avante garde motion picture, but more than an article in the New Republic. The condition of timelessness --of the suspension of contemporary time frames of reference-- is as much the case in the Federal Power Commission as in the high fashion cinema: The Commission works today in the framework provided by the 1920 Federal Water Power Act for fostering the growth of hydroelectric facilities, as well as on contemporary problems of pricing natural gas or electric power in interstate commerce. The confrontation would lack direction and purpose, as well, because the Federal Power Commission does not make decisions in a fashion so consistent or systematic that a strong bias for or against efficiency can be detected. Some of the scenario would seem aimless - a condition almost certain to guarantee cinematic success. But the confrontation would be extremely important for the growth and efficiency of the power and gas industries in the next few years, so that it should take place outside the cinema; in fact, it would be so serious that it would probably have to be relegated not to the political magazines but to confidential working papers of the Bureau of the Budget.

This review proposes to simulate such a confrontation where the emphasis is entirely on economic concepts of efficiency. Conclusions are reached on the efficiency of the use of resources in recent regulatory activities to do with electric power and natural gas production or distribution. Even if the Commission is erratic in its decisions, these conclusions are important since they are based on the latest Commission decisions. In that case, any 180 degree reversal would have implications in direct contrast to those of the present decisions. Alternatively, a lack of findings on the thrust of regulation in one of the Federal Power Commission industries suggests that the costs of regulation are a dead weight efficiency loss.

If such an exercise is carried out here on Federal Power Commission procedures, then the question remains as to what exactly the policy implications should be from any set of findings. If the Commission is "inefficient" in an economic sense, then it does not follow that it should be abolished or even reformed. Full requirements for economic efficiency could not possibly be put into effect, since the Commission was not brought into the world cast in such a mold nor was it given a mandate to acquire what it had not inherited. But there might be little objection to proposing changes in Commission procedures which add to economic efficiency, as long as these do not restrict the legal rights and prerogatives of the parties to regulation.

Efficiency in Regulation

The independent regulatory commission has a mandate from Congress and the Federal courts to provide a complex set of services to the industry with which it is concerned, and ultimately to consumers of the final products of that industry. The Commission could be found "efficient" in the technical sense of the word, after an intensive investigation has established that there is no likely alternative way of providing the given set of regulatory services at lower annual expenditure of Federal funds. But this is a narrow definition of efficiency, since the possibility exists that the Commission is minimizing costs of promulgating an unwanted or unnecessary set of rules.

The costs of the Commission are not total costs of regulation. The Commission could show greatly reduced annual expenses by instituting formal proceedings that shifted the costs to those companies being regulated, or to the final consumers of the regulated industry. The Commission could spend a great deal less by carrying out the same activities at a slower rate. In either case, the regulatory services would be maintained but those contributing to costs would be the recipients, so that the quality of government service would have greatly declined. The total expenses for all parties involved in regulatory proceedings should be considered the "costs of regulation" in

a strictly defined time frame of reference. Then, the costs of a given level of regulatory review can be assessed from the point of view of the economy as a whole.

Whether there should be the given level of regulatory activities is the central matter. Commissions in general are organizations for limiting business decisions, or for preventing the occurrence of certain patterns of market behavior in particular industries. The Commission's service is the nonoccurrence of particular levels of price, or the absence of firms or of particular qualities of products. The benefits to society from nonoccurrence can be measured in terms of the difference between the total economic value of goods and services under regulation and that value when the prohibited patterns occur. There are all kinds of measures of value, but the single measure allowing comparison with expenditures on the regulatory process is "willingness to pay" under conditions in which buyers can be said to have requisite ability to pay. Finding this in a particular case is difficult; but the approach of measuring areas under properly defined demand curves is not altogether unsuccessful in turning up an estimate of value for policy analysis. The Commission is efficient if it is providing services at least cost, and if the services show economic value or gains greater than these costs.

Even if the estimates prove to be somewhat accurate, they show that it is not enough for the Commission to set limits that have negligible costs of regulation, if these limits inhibit the production of goods and services for which the consumer is willing to pay. The Commission is answerable for the quality of regulation as well as its costs.

As a start, the Commission can be viewed as an organization that sets limits on maximum prices for an industry. For political reasons, certain prices must not be allowed - for example, when these prices are set by the monopolist at levels far in excess of long term costs of production, with the result that the firm makes "extraordinary profits". The Commission sets price ceilings close to the long term unit or average costs of production (measured in terms of "income statement" definitions of costs).

Two objections immediately come to mind. First, costs are the center of attention, in contrast with demands for products or services. For example, demands may change because of variations in the quality of the product or tastes of consumers over time, but prices would not change unless costs changed. Cost-based regulation could reduce both the level of price and the quality of the product; then regulatory benefits would be positive only if the volume of sales were not reduced. Second, the standard for ceiling prices equal

to long term average production costs is not inviolate. Even in the theory, there is a case for reducing the ceiling to long term marginal costs, so that marginal value as measured by price will equal marginal costs. But these are analytical objections. In practice, there is no evidence that the Federal Power Commission has required the equality of average prices and average costs. All that can be determined is that the Commission attempts to move prices down closer to average costs than would be the case without regulation.

Even when attention is centered on "tendencies" in regulation, the services provided by the regulatory agency can be assessed in terms of economic value to final consumers. There are two sources of benefit, shown in Figure 1.

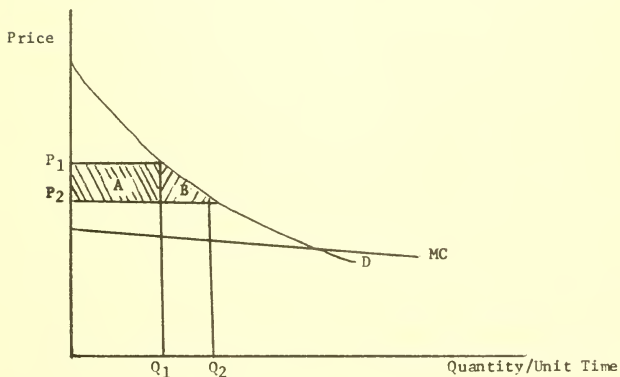


Figure 1

The Commission brings about price reductions, taking the market average price from P_1 to P_2 . With total market demands of all consumers for this product shown by the curve D , the reduced prices increase the quantity demanded to Q_2 .

The first gain is on established purchases Q_1 . The buyers are able to purchase the amount Q_1 previously demanded, but now at the lower price P_2 , so that they gain the monetary equivalent to $(P_1 - P_2)Q_1$. This is the amount of money "A" that they would be willing to pay over and above actual charges on Q_1 for the right to continue to purchase Q_1 . But this is not always a net economy-wide gain, perhaps not even to all consumers of this product, since it is at the expense of sellers experiencing a reduction of income by the same amount. Buyers that happen to be stockholders in selling companies would gain as much as they lose, if they buy the same proportion of output as they hold in producer's equity. Other buyers in the more likely cases of non-proportional ownership gain more or less; to assess net economy wide gains given these more general cases requires judgment on the social value of the resulting income redistribution. Such judgments have to be made on the gains of those buying this product or service against the losses of those receiving less dividends. If a dollar of area "A" gained by the purchaser is "worth" as much as two dollars of reduction in producers' incomes under regulation, then there is net economic value from this first effect of the price change.

There is a second consumers' gain, shown as area B, that is not derived from producers' income reductions. This is the total dollar equivalent to what buyers would pay for additional purchases ($Q_2 - Q_1$), over and above actual payments $P_2(Q_2 - Q_1)$, rather than go back to the unregulated price P_1 and quantity Q_1 . These gains, termed $\Sigma \Delta PAQ$ for successive small increments of price reduction ΔP and resulting quantity increase ΔQ , are not charged against producers' previous income on that output because it is all additional income.¹ But they are not to be realized unless certain conditions are present. First, prices have to be greater than costs; if they are not then the benefits are less by the total costs of additional output. A second qualifying condition is as important: the $\Sigma \Delta PAQ$ measure is a good measure of aggregate gains of consumers only if their distribution to some and not to others is judged to be the best distribution. Every dollar is taken to be of equal social value, no matter who receives it - the steel company using gas or electricity for production, or the poor widow-orphan using it for light and heat. There are third-level reservations, as well. The price reductions might well be substantial, if the Regulatory Commission moves vigorously against companies that have secure monopolies. Not only will the demand be increased but also there should be substantial increases in demands of complementary products and declines in demands for substitutes. These effects on other

¹See D. M. Winch, "Consumers' Surplus and the Compensation Principle", American Economic Review, vol. 55, pp. 395-423 (1965).

products should be taken into account, but they are not when attention is restricted to areas "A" and "B" under the demand curve for the regulated product alone.¹

The critical question, however, is whether any such measure of economic value or gain can actually be used by the efficiency expert to make the case for the regulatory status quo or alternatively for regulatory reform. In the representative regulatory commission, the information produced in the regulatory process is not for the purpose of making such assessments and is not useful for doing so. This is true for both costs and gains. The costs of Commission operations are calculated in straightforward accounting fashion in the budget and expenditure review departments of the Federal Government. But no assessment is made of costs imposed on the regulated firms --the costs of defense or intervention in regulatory proceedings-- so that an important element of total costs of regulation has to be estimated from information not shown by the regulator. Estimates of benefits depend critically on detailed information on market prices and quantities in the

¹Areas "A" and "B" do not reflect all consumers' gains because the shifts inwards or outwards of other demand functions from the regulated price reduction generate similar areas under other demand functions. There are likely to be negative or positive "surpluses" in other markets. Also, the demand function D in Figure 1 will shift as a result of changes in prices of those other goods; in the case of regulation-induced price reductions, the feedback from other markets is likely to shift the D curve inwards and to the left, so that $EAP\Delta Q$ is a maximum estimator of gains here.

absence as well as in the presence of regulation. Often there is some information on market behavior before and after regulation of some form went into effect. A good part of this information is worthless, because of lack of sufficient detail to distinguish increases in demand as the market grows from changes in quantity demanded (where the latter are ΔQ following from regulation-induced ΔP). The information on the production costs of the regulated companies is generally worthless. The long term marginal costs of production are invariably joint costs for many outputs in the public utility industries, and involve capital outlays over long periods of time not easily related to single-product production in one market period. In general the calculations by the Commission or by producing firms of the "rate base" --equal to undepreciated capital at original or replacement cost-- do not produce estimates of long term marginal costs for a particular product, so that it is not possible to tell whether regulated ceiling prices are below costs and thus are too low to produce measurable economic benefits.

But an initial attempt to overcome these problems can be made in the case of the Federal Power Commission. The costs of regulation can be estimated from a first limited survey of costs of defense in typical cases. The benefits are assessed from the Commission's own public portrayal of its accomplishments.

The Costs of Regulation by the Federal Power Commission

The Federal Power Commission's interests in corporate behavior are broad, as are its powers to regulate the companies producing or transporting natural gas and electricity. The opportunities for investigating corporate activities are so extensive that the only apparent limit on subject matter is the resources granted by Congress and the Executive Office to carry out inquiries; in 1968, the Commission investigated the widely-publicized power failures in Massachusetts and Pennsylvania and issued its opinions on their causes, while at the same time investigating the possibility of reorganizing the transportation of natural gas from the Gulf of Mexico to form a single "common carrier" system rather than a number of independently-operated pipe lines. Between these as limiting cases, the Commission's review into the accounting practices of the companies in these industries offered further opportunities for intensive inquiry into day-to-day activities. But the regulatory process for setting prices takes up the major part of Federal Power Commission activities each year. The chronological development of formal economic regulation begins with an application for a Certificate of Necessity and Convenience by the company seeking to enter some market for a product or a service. The certificate application is examined in hearings in terms of "sufficiency" of demand for the proposed service and of "capacity" of the company to provide the service. After certification has been granted and service has begun, then reviews of prices are undertaken --usually in response to appeals of the company for prices which will add

to "too low" a rate of return of capital-- first by a hearings examiner, then the Commission, and finally on appeal by the United States Courts. Limits on prices are set by forecast profits. The limit on allowed profitability of the company is set by the Commission's estimate of the costs of the capital needed to maintain the service demanded. Finally, there are surveillance procedures for ascertaining that the price-profit ceilings go into effect. All of these reviews require expenditures on Commission, court, and company personnel and supporting resources.

The expenditures of the Commission varied from \$11 to more than \$14 million in the 1964 to 1968 fiscal years. Part of this outlay was for services having market value and not related to regulation, however. In particular, some were incurred in managing resources on Federal lands, Indian lands, or in providing maritime navigation within the jurisdiction of Federal Power facilities. These outlays were accompanied by receipts of \$3 to 5 million from charges for such services rendered; if the charges covered "full costs", then they can be subtracted from total Commission expenditures to find the costs of regulation. There were other receipts that cannot be considered payment for services in this sense, but rather were charges for licenses and certificates that shifted the costs of regulation from the Commission to the regulated firms. Then the regulatory outlays incurred by the Commission, or debited

to firms by the Commission, were approximately \$8.5 million on average in any one of the last five fiscal years.

This was only on one side of the regulatory proceedings, however. Most of the costs of regulation were paid by the producers of gas and electricity or by the transportation companies in these industries that were defendants in cases or proceedings. There were roughly six classes of regulatory proceedings in 1967-1968 which required the services of industry experts, lawyers, and corporate executives for extended periods of time. The cost of these resources varied from case to case, but estimates can be constructed of average costs for each type of proceeding which are representative of most of the instances. These average costs multiplied by the number of "orthodox" proceedings came to more than \$125 million in a representative fiscal year. This amount might seem much larger than expected, but a category-by-category review suggests that it is not unreasonable.

The Commission requires that the electric power companies submit schedules of wholesale prices for review, and has carried out a campaign for complete coverage of all sales in interstate commerce since a 1964 Court decision affirming regulatory jurisdiction.¹ Approximately 2400 schedules are filed each year, with

¹Cf. the U. S. Federal Power Commission 1964 Annual Report, pp. 85 and 165.

supporting cost information. The Commission, on receipt of the filings, has processed virtually all of them; some of the filings are then used as the basis for the 40 to 50 "rate" or price studies carried out each year, and subsequently for the 25 formal "rate" cases brought before the entire Commission and appealed to the courts. Each step of this procedure is costly. Discussions and correspondence with a number of power companies has shown that, even if the filing of schedules involves no new rate or costing decisions, they cost at least \$100 of legal services and computer time to prepare. Thus the total costs of filings by the companies can be conservatively estimated at \$250,000. The rate studies and formal cases are much more expensive. The Commission staff carries out the studies informally, so that there are no direct legal expenses; but requests for information in complete and legal form are extensive and a number of power companies show "charges related to filings" of more than \$10,000¹ which are incurred while providing such detailed information. With 44 investigations each year, half of which are detailed studies of "costs of service", the total indirect costs of this stage of regulation must exceed \$440,000 each year. Formal cases build on these expenses, and then add to them. Correspondence with the companies involved in the 30 "rate cases" pending before the

¹Cf. the Form 1 Annual Reports for Electric Power Companies (1968) under the accounts "regulatory expense" (353) and consultants expense (355).

Commission at the end of fiscal year 1968 indicates that those involved in a full-scale rate review incur costs of close to \$200,000, while those litigating "terms" and "conditions" put on prices or on service may have to undertake expenses of close to \$125,000. The cases are not finished in one year --indeed, with the inventory now at 30 and growing at five per annum, the average case lifetime is close to four years-- and there are additional costs of delay and of greater uncertainty as to future charges and costs of service. Then the 10 cases finished in a year must cost \$1,750,000 when all costs over the case lifetime are included. The total costs of regulating electricity wholesale prices comes to an estimated \$2.44 million per year.

After prices have been set within the framework of regulation, the day-to-day operations of electric companies take place according to rules set once again by the Commission. Capital equipment used in operations has to be that specified in "costs" that determine rates. The Power Commission has been conducting field examinations of those capital expenditures actually made by companies, to ascertain that they are the "original costs" for providing the regulated services. More than 200 electric utilities filed documentation of the identity of accounting records on capital assets and the capital actually in use; more than 350 companies filed studies of classification of original

capital expenditures among types of service as well. These studies had value to the firm in their day-to-day operations so that not all of the costs can be attributed to regulation --for one, the companies learn where their equipment is. But the resources devoted to these activities are clearly beyond those found in cost surveillance in unregulated companies, and they have not been justified by the companies as "cost effective" in terms of lost and found equipment; a small sample of companies shows that costs cannot have been less than \$5,000 per annum in each company undertaking these procedures in any one year.¹ There were approximately 40 documentation and 75 classification reviews of present or proposed future facilities taking place in any one of the last five fiscal years - the period over which this particular review process has been conducted. A minimum estimate of the resource costs of regulatory accounting procedures must be \$.58 million per annum, as a result.

Regulation of prices charged by producers for natural gas sold to interstate pipelines has been in effect since the Supreme Court decision of 1954 in Phillips Petroleum Company v. Wisconsin (347 U. S. 672).

¹A sample composed of thirty firms showing \$10,000 or less of "Regulatory Expense" on Form L of the 1968 Annual Report to the Federal Power Commission, but without a rate investigation or a formal rate case underway; some of these reported costs (in private correspondence) from \$2,000 to \$10,000 on compliance procedures.

But there has not been effective regulation, in the sense of rules that impose limits on prices. The problem from that time to the present has been "how to do it" - how to set ceiling prices based on individual company costs, when the gas comes from wells jointly owned by a number of producers each with different costs, or from different wells in the same markets but with different exploration and production costs. Faced with highly complex solutions to the problem, the Commission has moved away from prices based on company costs to area price ceilings set in reference to country-wide average costs of exploration and development. Provisional prices were set for "new" and "old" contract volumes in 24 areas in 1960. Area rate proceedings have been underway in many of these areas since then. The Supreme Court in the Permian Basin Area Rate Case (390 U.S. 747) affirmed the legality of this price-setting method last year, so that regional price ceilings will be set on the basis of average development costs in the country at large, and (for "old" gas) on the basis of local production costs.

The gas producing company with newly discovered and developed reserves then has to go through a relatively new but highly formal procedure. This begins with obtaining a Certificate of Necessity to put the gas into the pipeline soon after a sales contract has been signed. The applications for Certificates now make up an inventory of approximately 2,000 pending cases per annum, of

which 1,200 are completed in the initial year and most of the rest in the second year. They have become more complex over time, with detailed reviews of contract prices as part of the assessment of "necessity and convenience". That is, since the certificate price can only be reviewed when increased under the present interpretation of the Natural Gas Act, this is the only point at which an initial review takes place. Thus those filings to the Commission include a showing that certificate prices are "in line" with those in the field region. The costs of administering and preparing them are substantial. At an earlier time, when they were primarily engineering studies, they seem to have cost from \$6,250 to \$12,500 each but now they must cost at least the larger of these two amounts.¹ The total costs of administration each year are \$25.0 million when the full inventory of cases is dealt with.

There are other, more substantial costs to the gas producers in obtaining a Certificate. These filings and Commission reviews take time - and the time spent holds up the production process, since reserves have to be secured and developed before certification, while production can only take place after the review is complete. This delay adds greatly to the expenses of producers

¹The earlier estimates are in R. W. Gervig, "Natural Gas Production: A Study of the Costs of Regulation", The Journal of Law and Economics (October 1962), page 86.

since they are necessarily holding lifetime inventories which are ready for sale at that precise time. In the early 1960's, these expenses came to as much as \$.17 per thousand cubic feet for every month of delay, and were the reason for a 3.5 per cent price premium attached to regulated interstate sales over and above unregulated within-state sales.¹ The delay at that time was more than five months, and the costs were a little more than 1 per cent per month at that critical early point in contract operations; if anything, the delay at the present time is slightly longer--the probable time length now is six months, with certificates processed more or less uniformly from one to eighteen months after application-- and the costs per month cannot be any lower. Then the 18 trillion cubic feet of new gas certified each year have cost $C_d = \sum_{i=1}^n c_i q_i [1 - \frac{1}{(1+r)^d}]$ more as a result of regulatory delay, where c_i is the present value of unit costs of gas quantities q_i in "n" individual contracts, and "r" is the monthly percentage costs of the delay period of length "d". Given other regulatory procedures, c_i has to equal initial base prices set by the Commission for field areas; these prices average close to \$.17 per thousand cubic feet (m. c. f.).² The volume of new reserves q_i dedicated under new

¹As documented by R. W. Gerwig, *op. cit.* page 86-88.

²If it is assumed that contracts were for reserves from new fields discovered in 1967 and 1968. More than 60% of the new fields were in Texas, 10% in Louisiana, and the remaining in other states; weighting the F.P.C. ceiling prices by these percentages results in the \$.17 average.

contracts has varied from year to year, but has been close to 18 trillion cubic feet in the last three years (an amount that has a present value as in inventory of 7.0 trillion cubic feet). With delay costs "r" of one per cent per month for six months "d", the first regulatory procedure typically cost a total of \$70.0 million in any one of the most recent years.

The most important function of regulation in natural gas fields is to set the producers' prices on sales to natural gas pipelines. This has been accomplished by setting "area rates" to apply as ceiling prices on all gas in an arbitrarily defined but large geographical region, and then by carrying out detailed reviews each year of 6,000 or so rate schedules to ascertain conformance of the individual companies to the area rates. The Commission has used or required producers to use far more resources in this pursuit of the maximum price than might reasonably be expected.

The "area rate" proceedings have been massive and prolonged. The first and only complete case began in December 1960 with hearings on prices set by 351 companies under 705 dockets covering gas in the Permian Basin of West Texas. Testimony and submissions were completed early in 1964 and were followed by a Commission decision in August 1965 setting a maximum price of 16.5¢ per m. c. f. on "new" gas-well gas (flowing for the first time after January 1961) and 14.5¢ per m. c. f. on "all other" gas (first produced before 1961). The Supreme Court

affirmed this decision in May 1968 and the Commission then began the last round of putting these ceilings in effect in place of the "interim" or "in line" prices which held at 16¢ on new gas and 11¢ on old gas. The work of a decade on a single set of area rates has not yet been completed.

Four more area rate cases have been initiated and are moving along to the decision stage - albeit on a faster schedule, given that much of the necessary documentation of costs and production has been collected for the Permian Basin proceedings. The approach in each instance has been the same, and has centered on finding the long term national average costs on exploration, development, and production which can then be adjusted for special conditions in the area of immediate concern. Economic and engineering research measures have been brought to bear on historical experience in drilling or production, to find the impossible: the separable costs of gas rather than oil exploration, for undiscovered reserves. The opinions that have resulted have been put into testimony by groups of more than 300 companies, or by most of the major 50 pipelines, or by the Commission staff, and then judged by the hearings examiners, the full Commission, and the courts of the United States.

The costs of these proceedings are very extensive. Most of the Power Commission's own expenses on gas regulation in the last few years have been incurred for staff devoted to preparing

briefs and testimony on area rates, and the producers have undertaken extremely thorough and expensive investigations of drilling and production expenditures throughout the country. They have retained more than 50 law firms, more than a dozen economic and engineering consulting companies to produce and deliver testimony before the Commission on prices set no lower than the estimates of costs from these expenditure data. Their costs over all of these area proceedings have never been calculated; but the examiner in the Permian Basin proceedings found that the total costs of regulation were .14¢ per m. c. f., and uncontested industry testimony in the Texas Gulf Coast Area proceedings showed that these producer costs come to .15¢ per m. c. f.¹ These average fixed costs of regulation include the costs of certification and of rate schedule review, as well as those in the area rate proceedings, so that they are too large to be an accurate estimate of the private expenses of the rate proceedings. But they are not far out of line because the respondents to the proceedings had long-established production contracts for the most part --so that certificate expenses were low-- and also because most rate schedule proceedings were suspended and replaced by the area rate reviews. The area reviews

¹Cf. Area Rate Proceeding, et. al. (Permian Basin) Docket number AR 61-1, 34 FPC 159 (1965) at 197; and the testimony of S. F. Sherwin, Exhibit number 42-J (SFS-1), Schedule 17 in the Area Rate Proceedings Docket numbers AR 64-1 and AR 64-2.

applied on approximately 75 per cent of the 18 trillion cubic feet of producer sales in each of the last few years, so that total producer expenditures on the area rate reviews must have been close to $(.0015)(.75)(18)(10^9)$ or \$26.3 million.

Since area rates have not been set to apply on all interstate gas sales, producing companies still file some individual rate schedules for review. Also, a number of cases have been filed as exceptions to the Commission-set maximum field prices, for reasons having to do with exceptional production costs incurred as part of joint oil and gas production expenditures, or with specific terms of the sales contracts, or with the conditions of state taxation or regulation. These cases have not been dealt with in a systematic manner, because of the necessity first to set maximum area prices and to have this procedure affirmed by the courts. Consequently, only 500 cases have been disposed of each year, while more than 1,500 new applications for rate increases have been filed in the same year. The stock or inventory of cases very obviously has been growing.

At the same time these individual rate reviews have become more complex because of interest in detailed accounting for gas well development expenditures. The arguments for a premium on area prices to pay for more directional drilling for

gas in deeper producing regions require extensive documentation by analysts from the economics and engineering professions. The documentation greatly inflates the costs of making an individual rate presentation. The full scale reviews of prices where there are not area rates cost a quarter of a million dollars while "area exceptions" cost at least \$10,000 the year in which the case is made.¹ Minimum total costs for the 500 cases dealt with have been \$5 million each year, given that the full scale reviews have been deferred in favor of the area rate proceedings and their possible exceptions.

The long distance natural gas pipeline companies resemble the electric utilities much more than do the gas producing companies. The market structure is similar. The interstate pipelines have been constructed to such a scale that some of them have regional monopolies over the supply of natural gas to retail gas utility companies, while others face the possibility of substitute sales by two or three independent pipeline sources of supply to city retail gas networks. The conditions of regulation are close to those for interstate sales of electricity. The pipelines obtain Certificates of Necessity and Convenience for rights-of-way to construct both their gathering lines in the gas fields and their distributing lines to retail gas utility companies. They file applications for price increases that show "fair return on fair value" of investment expenditures on their trans-

¹Estimated from reviews of the expenditures of defendants in the cases cited in volume 34 of the Federal Power Commission Reports (1965).

portation equipment, or that fully compensate them for expenditures on gas purchased in the field.

The Certificate applications, and the subsequent hearings and findings of the Commission, are much more detailed than the gas producer applications. The Commission seeks to determine whether the demands of retail gas utilities are sufficient to require full capacity operation of the proposed pipeline, and if there are sufficient reserves under long-term field purchase contracts to satisfy these demands. Documentation is found in a collection of field purchase contracts and wholesale sales contracts with long lifetimes - longer lifetimes than commercial conditions would warrant in the absence of this certification procedure, since the point of interest is in showing full use of the proposed facility for its lifetime, rather than profitable operation on the optimal planning horizon given the extent of uncertainty in this industry. Direct and indirect expenses of preparing and signing these contracts are extensive. They include costs of geological, legal, and economic expertise in preparing and filing the application, and the costs of preparing and delivering expert witness testimony before the Commission in hearings; some of these costs would be incurred in estimating that gas reserves were there and were deliverable, and some would be necessary for confirming the conditions of sale to retailers, but those from making certain that there was 12 to 20 years supply and demand must be

credited to the regulation. With approximately 400 applications in Federal Power Commission inventory in the last fiscal year, the total additional cost of regulation to the companies must have been a considerable amount.

The gas pipeline price increase or "rate filings" are certainly as extensive as the Certificate proceedings. Most involve percentage increases of all prices and some a revision of the structure of prices as well. The preparation of materials justifying the percentage increase cannot be done in a straightforward fashion. There have to be detailed company presentations of their estimates of production costs for proposed future throughput, along with studies of economic conditions in capital markets likely to provide funds for future investment. The analyses are judgmental and consequently extremely detailed and lengthy. Different financial and economic experts each describe their own judgments on future production and capital market conditions, leaving it to the examiner and Commission to choose the one that is going to be correct; the bases for choice obviously include the logic of the witness and the soundness of his statistical method but ultimately the Commission's own choice is judgmental. The more subjective the material, the longer and more detailed the proceedings, and the greater the expense of regulation. Legal charges alone have appeared to cost more than \$25,000 per full rate filing, so that the 1,500 cases now in "inventory" must have cost the regulated companies millions of dollars this last year.

The sum total of the private costs of regulation for the gas pipelines was \$2.5 million in this last year.¹ Both changes in Commission procedures and in lawyers' and economists' charges can change the total; also, a slight change in the mix towards more complex cases in the range of filings made in a year could revise it upwards by a large amount. But these are not likely events, given that the Commission has worked out highly formal procedures for finding costs and that it entertains differences of views only in narrow topics of cost allocation or in rate of return levels. The 1968 cases were quite orthodox, and they cost the defendants about what can be expected.

Then there are substantial costs to the defendant in each of the Federal Power Commission's procedures. A first, but indicative, review of available indicators shows that they may total to \$126 million, with more than \$120 million as a result of certification and rate reviews in natural gas production. Along with the \$8.5 million spent by the Commission itself, the total is \$134.3 million for the economy-wide costs of Federal Power Commission regulation in a single year.

The Benefits From Regulation by the Federal Power Commission

The five Federal Power Commissioners are in a position not

¹Compiled from "regulatory expense" and consultants' charges shown by each of the interstate pipeline companies in the Federal Power Commission Form 2 Reports for 1968.

only to call forth significant resources, both from the Congress and the industry being regulated, but also they have great latitude in the use of these resources. The standards for setting maximum prices are so general, given the mandates of Congress and the courts, that price or rate levels could be changed 25 per cent without changing any of the text of Commission decisions. Changes in emphasis on notions of statutory language can lead to significant changes in regulatory procedures and reviews. Given such discretion, what has been the behavior of the Commission? With a well-established organization and peremptory power to demand resources, what has been decided by the Commissioners, and what have been the effects of the decisions on the public welfare?

There are any number of ways of describing such results. The customary approach is to describe the legal materials themselves - to review the cases, centering attention on changes in emphasis by the Commissioners in interpreting the statute and the previous cases. An alternative approach is to assess directly the effects of years of decisions on the final users of the regulatory services, no matter what the decisions themselves "say". Such a social accounting is attempted here, in terms of the benefits to consumers from reductions in prices attributable to the regulatory commission, because this is the only way to measure the value of the resources used in the regulatory process.

The Commission itself attempts to show the social value of regulation in the Federal Power Commission Annual Report. The 1968 Report announced that during the last fiscal year "reductions in wholesale rate of electric power moving in interstate commerce and subject to the Commission's jurisdiction amounted to \$8.6 million, the largest total for a single year in the Commission's history. . . .While many rate filings were submitted by the utilities on their own initiative, nearly 70 per cent of the total dollars of rate decreases were the result of Commission action. . . ." (The Federal Power Commission Annual Report, 1968, page 19). These are meant to be the estimated gains from regulation in electric power.

There were much greater gains expected from imposing ceiling prices on field supplies of natural gas. "Area field prices", set tentatively at the initiation of the Permian Basin Area Rate Case, were lower than the current prices on sales of new reserves in 1960. The difference between ceiling and transactions prices on all volumes of gas produced in that region was supposed to be the total benefit to the consumer from regulation. The "in line" prices proposed by the Commission for sales of reserves at the wellhead in the South Louisiana area, the Hugoton-~~Anadarko~~ area in Kansas, the Texas Panhandle, and the Texas Gulf area, were lower than new contract prices there as well, and the resulting total "savings" in purchase costs of pipeline buyers were consumer benefits attributed to regulation. The Commission's (implicit) assessment of the benefits from these

newly established prices is in the 1964 Annual Report as \$434 million,¹ the amount collected by the producing companies subject to refund if the "in line" prices are found to be the legal maximum prices after the regulatory review is complete.²

The Federal Power Commission also saw benefits from reduced gas consumer prices as a result of gas pipeline rate investigations. The Commission stated that, "Of ten major proposals to increase [pipeline] rates by a total of \$63.4 million annually. . . One proposal, involving \$2.68 million annually was rejected and two involving \$95,400 annually were accepted without suspension. . ." (The Federal Power Commission Annual Report for Fiscal Year 1968, page 59). Another \$12 million of rate increases was withdrawn by the companies in the face of Commission opposition, and there were \$13.9 million in rate reductions required of the pipelines after Federal Power Commission rate reduction proceedings. The Commission actions in the gas pipeline industry resulted in \$28 million of rate reductions which, under a very broad interpretation of the statements in the 1968 Annual Report, became "consumer benefits".

¹Cf. the Federal Power Commission Annual Report (1964), page 140.

²Recent rulings requiring pipelines to pass through lower area rates to the consumer should lead to pipeline cost savings becoming consumer price reductions.

Such an accounting is more tolerant than economic analysis allows. The rate reductions accrue to some consumers as increases of real income, but other consumers in their roles as stockholders of gas and electricity companies experience income losses from price, profit, and subsequent dividend reductions. The income gains of the first group and the losses of the second cancel out, at least on that part of total consumption consistent with the higher price level, if the income distribution after the rate reduction is as acceptable as the distribution before the reduction. This transfer of income is shown as the area "A" equal to $(P_1 - P_2)Q_1$ in Figure 1, first as a positive change in income for the consumer and second as negative profits for the producers that are consumers here and elsewhere in the economy.¹ Only the consumption generated by the reduction in price can result in net gains to both groups, given that the area "B" under the demand function equal to $\Sigma P \Delta Q$ is not an income loss of the producers and is a gain of the consumers.²

¹There is no a priori reason to favor the consumer's income over that of stockholders, because there is no theory establishing the general equity of such redistribution. In fact, there is no theory implying that such redistribution makes income more equal; rather this is an empirical matter.

²There are more basic technical assumptions, all of which imply that all of the effects can be described by movements along this demand curve and do not come from shifts of this or other curves.

But even this need not be the case - the area $\Sigma\Delta P\Delta Q$ has to be net of costs of supplying the additional consumption. All that can be said is that under very particular conditions, the consumption gains $\Sigma\Delta P\Delta Q$ are not matched by income losses of producers (other consumers) because they occur only on additional consumption generated by price reductions.

Not only economic analysis but also conditions in gas and electricity markets may not allow so tolerant an interpretation of the results from regulation. Some rate reductions might have taken place in the absence of rate regulation, as part of the profit-making behavior of monopolists experiencing cost reductions. After all, monopolists are expected to reduce prices when scale effects are predominant, or factor costs decline as a result of technical progress, or when there is substantial entry of other companies on geographical or product fringes of markets long held on an exclusive basis. All these expectations are present in these two industries. There is some evidence on the existence of large scale economies in systems, and of forecast cost reductions from advanced nuclear reactors in electricity. Both industries face incursions by the other --they are not jointly controlled, as a rule-- and by coal and oil in industrial markets for energy. The company may be more than willing to credit vigorous regulation by the Commission, and reduce rates for reasons of profit.

Consider some of the announced reductions in wholesale electric power rates. The Federal Power Commission showed \$8.9 million of reduction in the 1967-1968 fiscal year, but claimed that only 70 per cent of this amount resulted from regulatory Commission initiative, so that their calculations of benefits from regulation show \$6.2 million in a single year. This is a first and potentially interesting indication of the size of the price reduction on all established sales (equal to $(P_1 - P_2)Q_1$ or area "A" in Figure 1). But two additional steps have to be taken to make it useful for assessing economy-wide gains. First, these gains of consumers have to be measured against the income losses of those receiving dividends from the electricity generating companies. Some decisions have to be made on units of measurement. Here, it is assumed that the income transfer has no net effect if those receiving are in the same tax bracket as those giving - that the present tax work expresses the social choice on how best to distribute income. Second, an actual crude calculation of net gains on area "A" has to be undertaken.

The amended calculation proceeds by groups of consumers. Those consumers that are industrial or commercial enterprises and that benefit from the price reductions surely gain no more in general than the producers lose. Their stockholders gain the dividends that the electricity company stockholders lose and --unless these particular individuals are "poorer" than the class of equity holders as a whole-- there is no net advantage. It is not possible to tell exactly how much "poorer" they are,

or what proportion of the \$6.2 million accrues to them; but assuming that they are of the same income class as all stockholders and that they purchase the same proportion as in total national electricity sales, then there is no net gain from the income transfer on 55 per cent of the dollar rate reductions.¹

The consumers in contrast may gain more than the owners of the electricity companies lose. The governments of this country tax consumers on income received in money wages and salaries at some rate marginally in excess of the Federal rate, but they do not tax income received in the form of price reductions on consumption goods. Then the implicit rate of social income preference for price reductions is very high. The preference for dividend reductions, as revealed by tax treatment of these incomes, is also very high; dividends are taxed at the corporate rate of 50 per cent before they are received,² and then a second time at the applicable personal income tax rate. Then reducing dividend incomes of electricity company stockholders

¹In a typical year in the late 1960's, commercial and industrial sales accounted for 55 per cent of total revenues from ultimate or final service each year. Cf. F.P.C. Statistics of Electric Utilities.

²Only so long as companies cannot take advantage of exceptions such as depletion or depreciation allowances. These exceptions of course reduce the real rate below the formal 50 per cent rate.

by \$1.00 transfers $(.50+t)(\$1.00)$ of "socially approved" income to consumers. With the average tax rate "t" on dividend receivers' own personal incomes equal to 40 per cent,¹ then the transfer to consumers results in gains of 70¢ on the dollar. The amended estimate of net gains on the 45 per cent of direct consumer sales in the \$6.2 million in area "A" is \$1.7 million.

Further economic gains are those in new consumers' surplus $\Delta P \cdot \Delta Q$ for unit changes in price P and subsequent quantity increases Q (shown as area "B" in Figure 1). As an initial maximum estimate of net gains --without accounting for the possibility of prices less than costs-- the area $(\Delta P \cdot \Delta Q)/2$ is used for the regulation-induced price reduction ΔP and for the resulting increase ΔQ in quantity demanded. We must estimate ΔP and ΔQ . The first can be found in percentage terms. The Commission tells us that reductions in the two most important cases were 5 per cent and 9 per cent of total receipts, so that the average of $(\Delta P)(Q)/(PQ)$ can be assumed to be 7 per cent. Demand elasticity in the most detailed and revealing research shows estimates from -.2 in the high income Northeast states to -.7 in the Southern states for home consumption and to greater than -1.0 in ten large using

¹The average income of all stockholders is estimated to be \$108,000 per year. This estimate is from weighting incomes shown in 1967 Statistics of Income (Individual Returns) by the amount of dividends received. Cf. U.S. Department of the Treasury Statistics of Income 1967. The average aggregate tax rate on this income, given personal deductions allowed in a four person family, cannot exceed 40 per cent. Then the implied rate of taxation on \$1.00 of pre-tax dividend income of an electric generating company is 50 per cent on corporate tax and 20 per cent on personal tax (or 40 per cent on the remaining after-corporate-tax 50 per cent).

industries.¹ A less exact but more current overall estimate of elasticity is -1.2.² Using this last estimate as an average for all (industrial and home) users, the first indicator of net benefits from this part of Federal Power Commission regulation must be $(\Delta P)(\Delta Q)/2 = (.08)(6.2)/2$ or \$260,000.³

The total annual benefits in "A" and "B" should last at least five years, and it may well be ten years before technology wrought changes in market structure and demand conditions vitiate these particular events in regulatory history. Then the present value of these Commission actions is equal to the present value of ten years of price reduction (discounted consecutively at 15 per cent per annum), an amount that comes to \$10.8 million.⁴

¹F.M. Fisher and C. Kaysen, A Study in Econometrics: the Demand for Electricity in the United States (North Holland, 1962), pp. 42, 50, 135. These are averages over states and industries, roughly in accordance with the amount of electricity consumed.

²P. W. MacAvoy, Economic Strategy for Developing Nuclear Breeder Reactors (M.I.T. Press, 1969), Appendix C, "Documentation of Forecasts". The elasticity is for price of electricity effects on the demand for generating capacity, and this is a long run elasticity.

³The calculation procedure is straightforward. There are three pieces of information: (a), $(\Delta P)(Q) = -(6.2)(10^6)$; (b), $(\Delta P)Q/PQ = -.07$; and (c), $P\Delta Q = -1.2Q\Delta P$ assuming that the elasticity of final demand is -1.2. From (b) and (c), $-P\Delta Q/PQ = -.084$ or $Q = \Delta Q/.084$. Substituting this expression for Q in (a), then $(\Delta P)(\Delta Q) = -(6.2)(10^6)(.084)$ and 1/2 of this amount constitutes a first estimate of consumers' surplus.

⁴The fifteen per cent discount rate is somewhat high, but deliberately so. There are two reasons: this is a realistic estimate of the rate of return in the private sector on resources drawn off for the regulatory process, and this accounts for the possibility of very high decay rates in court decisions when the economy changes rapidly.

This amount must be the maximum conceivable estimate of net benefits. The price reductions required by any one Commission order are usually small, and the costs of litigation not so small, so that the temptation of the company is to concede the Commission-sponsored reduction even when it takes some rates below costs. This is seen in the most recent formal case review of an electric power company's rate schedule before the Commission: the Northern States Power Company (in Docket E-7140) conceded \$254,468 of rate reductions based on 1963 schedules after an extensive cost analysis by the company showed "cost of service" of \$4.653 million and a parallel analysis by the Commission staff showed "costs" of \$3.486 million. There were no standards by which the difference could be resolved, since they "reflect differences in cost assignment and allocation procedures" (34 FPC 883, at 884). Without substantive procedures, the company could only assess its chances of winning in Court in a random process but after extensive additional costs of litigation. It chose to concede "without prejudice to its contentions" and the Federal Power Commission found this "an acceptable compromise of contested issues involving numerous judgmental factors" (Ibid.). The choice was between two regulatory changes, those in litigation and those in price reduction, whichever was less, but without regard to whether the second involved rates below production costs. The clear possibility

exists that these reductions took rates below production costs, with consequent loss of consumers' surplus.

There are two more reasons why this is a maximum estimate of the gains from electricity rate regulation. First, some part of the "Commission-induced" reductions would have occurred anyway. One company president said, in response to requests for estimates of the private costs of regulation, "in the early 1960's the Federal Power Commission for the first time asserted jurisdiction over the sales by electric utility companies to local distribution systems. . . . Although the Commission's jurisdiction had been defined by statute in 1935, the Commission under Chairmen Swidler and White greatly extended the concept of what constituted an interstate sale. In most states these wholesale rates had been regulated by the state commissions for many years. . . . Many state commissions still assert duplicate jurisdiction over such sales. . . ."¹ With duplicate regulation, some rate reductions were occurring as a result of the activities of state commissions.

Last of all, quite plausible conditions in electricity markets implying lower benefits could hold rather than those assumed above. The percentage price reduction, and the elasticity of consumers' demand with respect to that reduction, could well be

¹ Private correspondence initiated by the author.

much lower than the estimates used here. In fact, price reductions below five per cent, with a value of the elasticity of $-.2$ (as found by Kaysen and Fisher for home consumers in high income states) make the estimated consumers' surplus "B" from regulation so close to zero that it might as well not be considered at all. A reasonably cautious view of benefits restricts the estimated amount to that for area "A", for national average conditions "approving" the transfer of income, and this amounts to only \$9.4 million from one year's regulation.

The Federal Power Commission's suspension of natural gas field prices in the area rate cases is not enough of an "act of regulation" to show economic benefits. Since the area rate cases are still being decided, regulatory effects have not been realized. But timing alone is not the only reason for imperceptible results - regulatory gains are not going to be realized in the future in any straightforward way. Forecasts of effects ~~over the~~ proposed life-time of area rates are near to impossible, because of extremely complex and contradictory patterns of gains by some and losses by others.

The proposed area rates freeze prices at the level attained on the larger "packages" of field reserves in the early 1960's. Those prices "cleared the market" given the cost and demand conditions of that time. Now the conditions are not the same - population and income increases, changes in tastes in favor of cleaner fuels have increased demands by substantial magnitudes.

The question is whether there will be additional supply forthcoming to satisfy the greater demands for new contract reserves. The answer is to the point: with effective competition in field markets,¹ the imposition of 1960 price ceilings can only guarantee that the quantity supplied will reflect 1960 conditions. Then 1970 "increased demand" and 1960 supply conditions must imply excess demand.

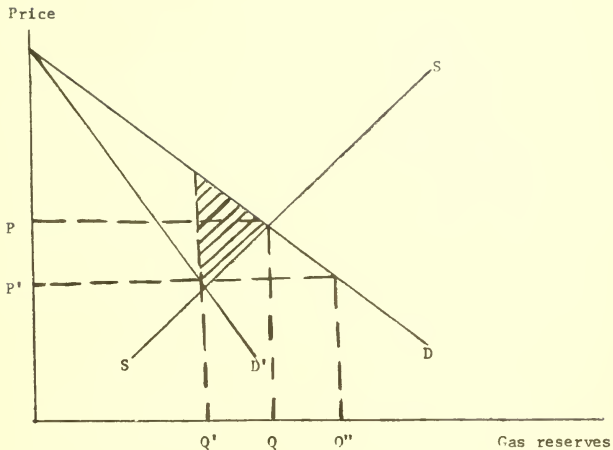
Excess demand in all circumstances reduces some consumers' benefits - those of consumers having to do without some part of the service that they demand. The lower prices generating the excess demands provide gas for established consumers at lower prices, so that others benefit. But the lower prices also ~~ben~~ reduce incomes of those receiving dividends from the gas producing companies. The gains have to be compared with the losses.

These gains and losses are illustrated in Figure 2, for a regional market containing uncontracted reserves of gas. The demand for additional reserves of gas to serve new industrial and home consumers is shown as the curve D, with additional reserves sought by pipelines at lower prices per thousand cubic feet. The supply of these reserves --found

¹The effectiveness of competition here is one of the most researched topics in industrial economics in the last few years; cf. review and citations in E. Kitch, "Regulation of the Field Market for Natural Gas", The Journal of Law and Economics, October, 1969.

in exploration for gas and oil, and developed by additional drilling beyond the exploratory well--is shown by the curve marked SS. The market clears at price P cents per thousand cubic feet and quantity Q trillion cubic feet; but the Commission sets area rates that average only P' so that the quantity demanded is Q'' while the quantity supplied is Q' . Then the smallest possible loss to excluded consumers is the shaded area in the diagram, since this is the graphical representation of the net amount over costs that the (unsatisfied) consumers would pay to receive more output than Q' . The greatest possible loss is the whole area between the two curves D and D' above the supply curve; this would occur if some consumers are excluded outright and all of the demands of other consumers are met - an instance in which pipeline extensions to certain locations are simply not allowed because "reserves are insufficient". Either of the loss estimates have to be balanced against the potential gains to those receiving all they want. Those gains are part of the income transfer shown as the area $(P-P')Q'$; but they are only part because some of the transfer is to other industries besides the gas producing industry, and some is to consumers with "socially-less-desirable" incomes. We shall attempt to estimate this residual gain, as well as the losses from excess demand.

Figure 2



The losses of unsatisfied gas consumers must have been substantial in recent years. Many of them have not been aware of their own circumstances, because the pipelines have been providing gas now for new customers that they will hardly be able to serve in the future. Also, the estimates of losses are likely to be very crude and subject to wide variance so that there may be differences of opinion on their magnitude; but even first indications should average to substantial "foregone income" from having to go to second-best energy sources.

Here the losses are assessed by first finding the magnitude of excess demand ($Q'' - Q'$), then estimating the area under the

demand function D between Q' and Q'' , and last subtracting out the area under the supply curve SS between Q' and Q'' . This procedure leaves the shaded area in Figure 2 as a residual. So as not to exaggerate the losses, this residual is made as small as seems reasonable.

Excess demand ΔQ or $(Q''-Q')$ depends on the amount of new reserves needed to replace production on existing sales, and on the amount needed to meet commitments to new buyers. The Federal Power Commission operates on the rule-of-thumb that reserves on the initiation of delivery to a final buyer are sufficient when the pipeline can continue that rate for twenty years; that is, estimates of demands for reserves are based "on the assumption that each new market commitment is backed by a twenty year supply."¹ To make the rule-of-thumb commitment on new sales, new reserves should be found and developed equal to twenty times the increase in production from year-to-year; these amounts are shown in column (3) of Table 1. To maintain commitments on old sales, the same rule would apply; then in this category, gas producers should bring forth on average an amount of new

¹Federal Power Commission, A Staff Report on National Gas Supply and Demand (Bureau of Natural Gas, Washington, D. C., September 1969) p. 18.

Table 1: Estimates of Supply and Demand for Reserves in the United States

(1) Year	(2) Additions to Reserves (trillions of cubic feet)	(3) Reserves Required for Additional Production (trillions of cubic feet)	(4) Reserves required to Replace Depleted 1962 Reserves (trillions of cubic feet)
1962	19.5	18.2	13.6
1963	18.2	16.0	13.6
1964	20.2	18.2	13.6
1965	21.3	25.8	13.6
1966	20.2	17.8	13.6
1967	21.8	19.9	13.6
1968	13.6		

Note: Column (3) is additions to production in the year following that year listed in column (1), multiplied by 20. For example, the net change in national production of gas in 1963 was 909 billion cubic feet, so that required reserves in 1962 equal (909) (20) or 18.2 trillion cubic feet.

Source: A.G.A. Reserves of Crude Oil and Natural Gas in the United States, volume 23, May 1968.

reserves equal to established production.¹ For sales that took place before regulation, this would seem to require new reserves of 13.6 trillion cubic feet each year (the amount of 1962 sales, as shown in column 4 of Table 1).² The two commitments together have required more reserves than those found on newly developed average (shown in column 1), at a minimum by an amount of 7 trillion cubic feet per year in the period 1962-1967.³

The area under the demand function over the range of excess demand can be approximated if estimates are available of the amount of excess demand (7 trillion cubic feet), and the amount

¹If production on old contracts equals X, an amount that is 5 percent of committed reserves R in every case, then new reserves to maintain the rule-of-thumb should be $\Delta R = .05R = X$.

²But only if two conditions hold. First, there would have had to have been no excess holdings of reserves in earlier years. This would seem to have been the case, since the reserve-to-production ratio was close to 18/1 and prices on new contracts were rising in the late 1950's and early 1960's. Second, there should have been continued demands of established buyers at the regulated prices (plus transport charges). This may well not have been the case; some part of deliveries were being made at prices below the regulated prices, and increases to the "new gas" rate level might well have caused these demands to vanish. As a conservative estimate, approximately 7.5 of the 13.6 trillion cubic feet consumed by established buyers is considered to be replaceable by an equal volume of new reserves, since this amount covers the major part of consumption demand and only a minor part of industrial demand.

³The average difference between (a) reserves in column 2 and (b) "commitments" in column 3 plus 7.8 trillion cubic feet of column 4, was -6.9 trillion cubic feet per year. This is the "reasonably low" estimate of excess demand ($n - n'$) used here.

of "cleared" demand (on average, approximately 21 trillion cubic feet of new reserves in most of the last few years). Also, there has to be an estimate available of the elasticity of demand for additional reserves.¹ In fact, there are many demand studies of final users of gas, the most complete and analytically convincing being those of Pietro Balestra.² His studies of incremental demands of home consumers provide an indication of the demands for new reserves to be produced for more home consumption; they show an elasticity of -1.3 in the last year of the study (1962).³ Demands of industrial users, accounting for almost 50 per cent of the total volume of production at the present time, have not been analyzed in a dynamic model; but studies of industrial buyers at different locations with varying gas prices show elasticities in consumption exceeding -1.5.⁴

¹The area under the demand curve between Q' and Q'' , and above the existing regulated price P' , is approximated by $\Delta P \Delta Q / 2$. Here $\Delta Q = Q'' - Q'$ and $\Delta P = P \Delta Q / Q e_p$ with e_p equal to the elasticity of demand for new reserves. Then $\Delta P \Delta Q / 2 = P' (\Delta Q)^2 / 2 Q' e_p$.

²P. Balestra The Demand For National Gas in the United States Amsterdam, the North Holland Publishing Company (1967).

³op. cit., section 4. 3. 7., pp. 95-99.

⁴cf. the Federal Power Commission's econometric model, as in Testimony of J. Harvey Edmonston, Federal Power Commission Docket AR61-2, "South Louisiana Area Rate Proceeding." The model contained in this testimony has been severely criticized because of a feedback system from demand to supply that always "clears the market" at the demand-determined price. But the industrial demand sub-system has not been open to such criticism; indeed, it is used here because it is the same as many other studies of industry demand for gas.

The weighted average of home and industrial elasticities is close to -1.28^1 ; then the gross loss of consumers' surplus $\Delta PAO/2$ from excess demand is estimated at $(\Delta P)(\Delta Q)/2 = P'(\Delta Q)^2/2e_s = \115.8 million.

The net loss is equal to this imputed loss on sales to consumers not receiving service, minus the cost of the additional service. These costs are shown as the area under the supply curve over the same range of excess demand of 7 trillion cubic feet. To make calculation of this area, all that are needed, in addition to the estimates above, are the elasticity of the supply function e_s and the market clearing quantity Q at the unregulated price. To find the elasticity of supply, we turn again to the F.P.C. econometric model of gas prices. There we find that reserves $\{R = 3.5 + .257Y.f\}$ where Y is the number of discovery wells and f is footage drilled; removing the defective feedback from production (demand) to reserves (supply) in Y results in a direct price-supply relationship² with an elasticity close to $+244$.³

¹The weighted average also follows from an assumed zero elasticity on 10 per cent of demand classified neither as "household" or "industrial".

²cf. The testimony of P. H. Cootner in rebuttal of J. Harvey Edmonston, Docket AR61-2, "South Louisiana Area Rate Proceeding". Professor Cootner recalculates the equation after removing this feedback condition, and the recalculation is used here.

³In shortened form $Y = \alpha P^\beta$, where α is a series of variables unrelated to price, and $R = 3.5 + .257 (\alpha P^\beta).f$. Then $e_s = P \frac{\partial R}{\partial P} = \beta(.257 \alpha P^\beta)/R = \frac{\beta(R-3.5)}{R}$. In this case, taking $R = Q^* = 21(10^{12})$ and $\beta = .293$ (from P. H. Cootner, op.cit.) results in $e_s = +244$.

To find Q , we note that the change in P to bring forth supply is equal to the change P required to reduce demand to the market clearing level, and solve $\Delta P = \frac{Q-Q'}{Q} \cdot \frac{1}{e_s} = \frac{Q''-Q}{Q''} \cdot \frac{1}{e_d}$.

The estimated market clearing quantity Q is close to 22^s trillion cubic feet per year in a "typical" year in the late 1960's--an amount very close to the amount found under regulation. Then the area under the supply curve is close to \$99.1 million¹ and the losses to consumers from excess demand are \$115.8 - \$99.1 million or \$16.7 million per year. No one knows how long such losses will continue to be part of the regulatory process for setting gas field prices. At one extreme, they could continue for the lifetime of an area rate schedule set this year, so that total loss could be the present discounted loss of ten years recurrence of \$16.7 million, or \$84 million. At the other extreme, 1970 could be the last year of excess demand because the Commission will move rapidly to raise rate ceilings in the pending cases and to revise upwards those in the Permian Basin decision, so that total losses are limited to five years (1966-1970) or \$66.8 million worth. The rate reviews have clearly taken five years, so that the costs of litigation in "one year's regulation" have been repeated five times over; for comparability

¹This area is found by solving $\Delta P \Delta Q / 2 = P' (Q'' - Q') / 2 Q'' e_s$ with the values in the text, given that $\Delta P = P' (Q'' - Q) / Q' e_d$, and $\Delta Q = Q'' - Q'$.

of costs of regulation in one year to benefits from regulation from that one year's activities, the negative benefits or losses of some consumers are limited to from \$17 million to \$13.4 million.¹

Other consumers have been able to obtain the amounts of gas they demanded, and they have gained from the price reductions imposed by the Federal Power Commission. Their benefits are not likely to be equal to the amounts now collected by the producers "subject to refund" after the area rate proceedings are complete, because these amounts imply much lower ceiling prices than those likely to be put into effect. In fact, the ceiling prices set in the Permian Basin area rate proceeding were equal to those on non-regulated transactions in the early 1960's; as Commissioner O'Connor stated in his separate opinion in that proceeding: "From the record in this proceeding, for the period with which we are concerned, the overwhelming volumes of gas well gas are sold under new contracts at the weighted average price of 16.5 cents (the area rate)"². As a result, most "refundable collections" on Permian Basin production will not be refunded and similar findings on the ceiling rates elsewhere will have similar results.

¹The difference between this calculation and those for benefits from electricity regulation is that the area rate cases are not complete, while all those analyzed for benefits from electricity regulation were complete. The assumption is made here that the area rate reviews will be complete after five years, and benefits are B/5.

²Area Rate Proceeding No AR61-1, 34FPC159, at 265. Similar findings apply to "old" gas production.

The gains have been made on contracts signed for production of reserves after 1965. Excess demand for these reserves was a result of prices, perhaps, two to three cents too low at the margin -- the shaded area of losses in Figure 2 followed from the ceiling rate P' being held constant while increased demands would have cleared at a market price P some two cents higher. The difference $(P-P')$ on the completed sales Q' is the maximum amount of gains for "satisfied" consumers.

The consumer's gains here are the producers' losses. Since the case can be made for net gains only on sales to home consumers at the reduced price P' , they are limited to that part of total new reserve sales made in interstate commerce for resale to home consumers.¹ In each of the last few years, approximately 18.3 trillion cubic feet of new reserves were dedicated to interstate pipelines under the rate ceilings, and perhaps 25% of the amounts were for final delivery to home consumers.² Then the gains were limited to two cents per thousand cubic feet on 4.575 trillion cubic feet, or \$64 million each year.³

¹The argument here is the same as for income transfers from lower electricity prices: all industrial producers or consumers are in the same income class, but home consumers are in a lower income class; the value of transfer to the lower income class is shown by the marginal tax treatment of a dollar there rather than to the gas company's dividend recipients.

²Of the Annual Report of the Federal Power Commission, statistics on gas reserves and sales for resale to home consumers in the 1966, 1967, 1968 issues.

³As in the case of income transfers from reduced electricity

There is substantial basis for believing that these gains will be realized in the near future, when area rate proceedings are completed; at least the market in the last four years has indicated this by the queue for new reserves. Future gains of this magnitude can be expected, however, for no more than five years since additional rate reviews are likely to result in smaller price reductions in face of the pressures from excess demand. The total gains for established consumers have present value, then, of approximately \$64 million.¹

The net benefits to consumers as a group could then equal the gains of the advantaged of \$64 million minus the losses of the deprived of \$13 to 17 million. At least such an estimate is plausible, if not convincing. Gains could be more than this, if price reductions spread to interstate sales as a result of attempts to sell more in non-regulated markets. Costs could be much greater if some consumers are required to go without gas entirely (so that the entire area between demand curves D and D' is lost); this might increase total losses to as much as \$44 million each year if there is a five year period assumed for the lifetime

prices, it is assumed that consumers gain $(50+t)$ dollars for every dollar at reduced dividend income, and that $t=.20$ marginal reduced tax rate on the recipient. Then this \$64 million is 70 per cent of gross gains.

¹This calculation assumes that it will take five years of regulatory expenditure to attain five years of gains of \$64 million per annum. Both gains and costs occur over roughly the same time period--although the gains occur mostly at a later date. As a first approximation then, costs for one year of regulation

of present ceilings, or to \$63 million each year if a ten year lifetime. These other possibilities show that our estimate is only a beginning indicator of gains from price controls, and that they are biased toward larger gains than those most likely realized.

The Commission's proceedings concerned with the rates set by the interstate gas pipelines had measurable benefits. The amounts may well have been smaller than those associated with either regulation as applied to electric power prices or as applied to gas field prices, but they are more likely to have been reflective of real savings. The Federal Power Commission disallowed \$2.69 million of new price increases proposed during the last year as well as \$12.0 million of previously-proposed increases.¹ They were responsible in some part for \$13.9 million of rate reductions the last year and \$50.9 million the year before, "which were, in large part, flowthrough of supplier refunds and rate reductions."² The most flattering view of all this activity would credit these reductions entirely to the Commission--none of them would have taken place in the absence of rate reviews, even though there might have been circumstances in which it was profitable for the firms to pass on cost reductions in price

times five equal total regulatory expense, and one years benefits of \$64 million times five equal total benefits. For convenience, neither costs nor benefits are given in total value terms here but rather in terms of one year's results.

¹cf. the Federal Power Commission Annual Report (Fiscal Year 1968) p. 59.

²op. cit., p. 60.

reductions. But even given such a view, credit can be taken in pipeline regulation only for the first two sets of reductions since the third already has been attributed to field price regulation; and this credit is for reductions of 10% under unregulated prices at the most, so that the net gains from more consumption $\Delta P \Delta Q / 2$ have equaled \$1.88 million.¹ The accompanying gains from distributing stockholders' income to consumers were limited by the small consumer participation in final demand; with 25 per cent of final demand coming from home consumers and 70 per cent of that equal to the indirect income gains from redistribution to "poor" consumers from "rich" stockholders, the net benefits in one year are estimated at \$2.57 million. At most, ten years of gains of these magnitudes may follow from one year's regulation, so that the present value of the year's activities in setting rates for natural gas pipeline companies is close to \$22.3 million.

A Review of Costs and Benefits, And an Economic View of
Commission Reform

The impression gained from the Federal Power Commission's activities and the responses of companies in the electric power

¹This calculation proceeds in exactly the same fashion as those for finding consumers' surplus from electricity rate reductions. Given that $(\Delta P)(Q) = \$14.69$ million, $\Delta P/P = 10$ per cent, and the elasticity of demand is -1.28 as shown by the econometric demand relations for gas described above, then $\Delta P \Delta Q / 2 = (.10P)(-1.28Q \Delta P/P) = (.10)(-1.28 \Delta P \cdot Q) = \1.88 million.

and natural gas industries is one of vigorous and meticulous enforcement of regulation. All that activity cost at least \$134 million during a typical year in the late 1960's. The expenditures were made to protect the consumer, and undoubtedly some consumers gained while other consumers and most of the stockholders lost; but ignoring the unevenness of the effects, the net gains to consumers from Commission initiated price reductions are much less than the costs. As shown in Table 2, the benefits can be added up to roughly \$80 to \$85 million -- but no more than that, even when accounting for all reasonable future gains from this one year's set of decisions. The Commission seems to initiate the use of resources each year which cost 60 per cent more than the dollar value of benefits from their use.

The more detailed accounting for benefits and costs points out the areas of Commission activity most out of balance. The commission's activities in the pricing of electric power required \$3 million of litigation expenses, some of which has extremely burdensome to the companies because no working rules resulted; nevertheless, the present value of future rate reductions seems to have been more than \$7 million greater in one year than these costs.¹ This was not the case for natural gas

¹This is not to deny that the costs of some procedures in power regulation are greater than benefits from those particular procedures. Correspondence with the power companies on their costs of regulation pointed to certification and rate filing procedures which duplicated the work of state commissions completely with zero benefits.

Table 2: Accounting For Costs and Benefits

<u>Federal Power Commission Activity</u>	<u>Estimated Costs</u>	<u>Estimated Benefits</u>
	(millions of dollars)	(millions of dollars)
1. Electricity price regulation	2.4	
2. Accounting reviews for compliance of electricity companies to regulation	0.6	
<u>Total Electricity</u>	<u>3.0</u>	9.4 to 10.8
3. Certification of gas producer sales	25.0	
4. Regulatory delay in gas producer sales	70.0	
5. Area rate proceedings in gas producer sales	20.3	
6. Producer rate review	5.0	
7. "excess demand" effects of producer price ceilings		-13.4 to -17.0
<u>Total gas producer sales</u>	<u>120.3</u>	64.0
8. Gas pipeline certification and rate review	2.5	22.3
9. Direct Expenditures of the Commission	8.5	
<u>Grand Total</u>	<u>134.3</u>	<u>78.7 to 83.7</u>

field price regulation. The procedures have been burdensome in every case, beginning with certification of spot sales of new reserves costing more than \$25 million each year and continuing with the rate proceedings themselves which cost another \$25 million. The indirect expenses of the companies, from delays in production imposed by certification and review, must have exceeded \$70 million each year. Altogether, the costs exceed the benefits -- themselves reduced by losses of consumers with regulation-induced excess demands -- by more than \$70 million. In comparison, the results from pipeline regulation are prosaic. For no more than \$2.5 million of annual outlay on certification and rate review, the Commission has made contributions to consumer rate reductions modestly estimated to be worth more than \$22.3 million.

The Federal Power Commission must make its own calculations, if only to provide a check against the use of simulation with public records as attempted here. If they do, or if the same is attempted by Congress and the Executive, they surely will see the effects from the imbalance of regulatory activities towards gas field price regulation. The scale of these activities is ten times greater than those in the "orthodox" public utilities; that alone should raise questions as to whether the bureaucracy either in or engendered by field price regulation has not grown too fast and too large. But the ultimate question is whether the commission

and the rest of the Government can see in the imbalance of benefits and costs a lesson in economic reform. Those activities, particularly certification, which make the direct and indirect expenses of producer regulation so great could be curtailed. The case for certification lies in the need to curtail the use of the power of eminent domain, as practiced by a transportation company, and it is not made here; rather, the case is for a highly individual form of price and quantity review on the signing of a sales contract by a (regulated) producer with a (regulated) pipeline buyer. This is a case that is exceptionally weak, because both buyer and seller go through periodic price and quantity reviews and these reviews can be revised by Commission rulemaking and court reviews to take over the functions of certification proceedings in a more aggregative and less costly procedure.

The field price (rate) proceedings themselves ought to now be the central subject for economic reform. An "input-output" analysis of the crudest sort shows the unsatisfactory state of affairs here. Even the Commission's own review should point out that they are using more than \$25 million of resources each year to do no more than redistribute income. Many other agencies, including the local governments searching for the windfall gains in energy raw materials production, can do this much better because they do not use these litigation resources in the process.

Moreover, they do not add to the maldistribution of resources, by having some buyers go without gas in order to increase the incomes of others. But this puts the alternative to the Commission: regulation of field prices by automatically certifying all competitive transactions, so that other agencies then can move on to redistributing income. The means are available for doing so via Commission interpretation of the Supreme Court's mandate for producer regulation; as elucidated by Commissioner O'Connor in the Permian Basin Case, "a market price has been established which provides a reasonable measure of the rate necessary to elicit supply... There is no substantial difference between market and costs in the Permian. Either method is presently permissible for purposes of area ratemaking. The Federal Power Commission has the power to reduce its own scale of activities by centering its research on the competitiveness of markets and then approving all competitive market prices. The costs of regulation would be reduced to a size comparable to those in electric power and gas pipeline regulation. Then the policy decision has to do with the wisdom and courage required of an agency to reduce itself to one fifth present scale.

¹Commissioner O'Connor, op.cit. p 265.

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